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Since the first term becomes much larger than the second as p increases, the number of homozygous normals becomes very great compared with the heterozygous normals.

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FURTHER OBSERVATIONS ON SEX IN MERCURIALIS ANNUA

IN an earlier paper,¹ I briefly mentioned the occurrence of so-called monœcious forms in *Mercurialis annua*. I have since then continued my studies upon such forms and this report deals with the offspring of the so-called monœcious plant, No. 3. It is to be noted that *Mercurialis annua* is described as appearing in

¹ Inheritance of Sex in *Mercurialis annua*, *American Journal of Botany*, Dec., 1919.

three forms, male, female and monœcious. Several hundred seeds from plant No. 3 were sown in Fargo, North Dakota, in the spring of 1919. Owing to a protracted drought only four plants survived.

In their general habit of growth these plants were like the females of my earlier observations—the flowers were clustered



FIG. 1. Branch *Mercurialis annua*. *a*, male flower bud; *b*, female flower bud; *c*, female flower; *d*, male flower; *e*, hermaphrodite flower.

in the axils of the leaves, either sessile or on more or less elongated peduncles. In another paper (Mss.) I have described in detail the various floral arrangements that appeared on these plants. Female flower buds are conical. The male buds are smaller than the female buds and they are spherical. The hermaphrodite flower buds are like the female buds though sometimes smaller. Just prior to the opening of the hermaphrodite

flower buds, the anthers may be recognized through the sepals. These four plants are not monœcious, since male, hermaphrodite and female flowers appeared simultaneously on the same plant.

Plant No. 3-1 made a vigorous growth from the beginning. Its foliage was dark green. The first flowers were female and these were produced in increasing numbers. No attempt was made to count the female flowers prior to the appearance of male and hermaphrodite flowers. As can be seen from the table the female flowers always outnumbered the male and hermaphrodite flowers. Until September 10 the male flowers were more abundant than the hermaphrodite. On September 12, there was a sudden increase in the number of hermaphrodite flowers. This rather sporadic appearance of flowers other than female flowers shows how impossible it is to determine at one time the sex of the individual. It is apparent that it is essential that such individuals be studied throughout their whole life history. Thus through the first three months of its history this plant was female, after that it was polygamous, monœcious, and gynomonœcious. It was polygamous when beside the female flowers there appeared male and hermaphrodite flowers, monœcious when only male flowers appeared in association with the female flowers, and gynomonœcious when hermaphrodite flowers appeared together with female flowers. The total number of male and hermaphrodite flowers was about equal (table). This plant may be characterized as a polygamous one.

While there were no definite points at which male or hermaphrodite flowers appeared, there were branches that continued to produce only female flowers throughout the life of the plant. Thousands of seeds were collected from the plant.

Plant No. 3-2 like plant No. 1 made a vigorous growth. Its foliage was much lighter than that of plant No. 1 but the plant was healthy. As can be seen from the table the number of male and hermaphrodite flowers that appeared at one time was relatively larger than in any of the other plants. This condition was maintained throughout the life of the plant. This plant from the time of the appearance of male and hermaphrodite flowers was decidedly polygamous, prior to that it produced female flowers like plant No. 1. During the period in which the three kinds of flowers were counted, female, male, and hermaphrodite, the male flowers were in excess. It may be conceived

then that during a part of its life history the male elements predominated. This plant was a very prolific seed producer.

Plant No. 3-3 was a very vigorous grower and it behaved like plants Nos. 1 and 2 until the time of the appearance of male and hermaphrodite flowers. The total number of male flowers when compared with the total number of hermaphrodite flowers showed that the tendency of the plant was towards monœcism. While during most of its later history male and hermaphrodite flowers appeared together, towards the end of the growing season (October 3-12) no hermaphrodite flowers were found and the plant was decidedly monœcious. This plant started out as a female, became polygamous and towards the end became monœcious. Many seed were set.

Plant No. 3-4 started out as a vigorous plant producing in the beginning female flowers in abundance. About the same time that the other plants were producing increasingly large numbers of male and hermaphrodite flowers this plant produced very few, 10 males and 4 hermaphrodites. After that the plant began noticeably to lose in vigor, the leaves began to curl up. The plant after that produced female flowers in abundance. These however dried up very quickly and dropped off. The plant continued its sickly growth until it was killed by frost.

Pistillody and staminody occurred very abundantly in the flowers of the first three plants. This condition I have described in detail in another paper (Mss.). Many of the hermaphrodite flowers had only a single stamen. The plants also produced a large number of three-carpelled female and hermaphrodite flowers whereas a two-carpelled flower is the rule.

While the number of plants is too small to warrant the drawing of any definite conclusions the following suggestive facts are brought out.

1. Sex is not a fixed condition in these forms of *Mercurialis annua*.
2. A plant may change its sex during the progress of its life cycle.
3. Continued study with larger numbers of such plants will very likely show marked variations and sex intergradations and that a strict category of sex for these forms is untenable, so that the terms monœcious, gynomonœcious, gynodiœcious, etc., can be only arbitrarily employed.

Plant	May 25 to Aug. 25			Aug. 27			Aug. 30			Sept. 1			Sept. 4			Sept. 8		
	Only ♀ Flowers Pro- duced			♀ Fls.	♂ Fls.	♀ Fls.	♀ Fls.	♂ Fls.	♀ Fls.	♂ Fls.	♀ Fls.	♀ Fls.	♂ Fls.	♀ Fls.	♂ Fls.	♀ Fls.	♂ Fls.	♀ Fls.
3-1	∞	∞	11	2	∞	4	—	∞	5	1	∞	4	6	∞	40	10		
3-2	∞	∞	25	6	∞	70	36	∞	294	298	∞	158	163	∞	282	126		
3-3	∞	∞	5	1	∞	3	4	∞	2	—	∞	9	4	∞	15	9		
3-4	∞	∞	—	—	∞	1	—	∞	6	4	∞	—	—	∞	3	—		
Plant	Sept. 10			Sept. 12			Sept. 16			Sept. 18			Sept. 22			Sept. 25		
	♀ Fls.	♂ Fls.	♀ Fls.	♀ Fls.	♂ Fls.	♀ Fls.	♀ Fls.	♂ Fls.	♀ Fls.	♀ Fls.	♂ Fls.	♀ Fls.	♀ Fls.	♂ Fls.	♀ Fls.	♀ Fls.	♂ Fls.	♀ Fls.
3-1	∞	18	8	∞	—	150	580	50	40	—	120	40	—	200	20	100		
3-2	750	700	450	750	850	550	590	650	350	301	550	512	—	165	225	60		
3-3	∞	22	4	220	220	60	?	20	?	60	200	50	120	340	—	180	110	30
Plant	Sept. 27			Oct. 3			Oct. 12			Total								
	♀ Fls.	♂ Fls.	♀ Fls.	♀ Fls.	♂ Fls.	♀ Fls.	♀ Fls.	♂ Fls.	♀ Fls.	♀ Fls.	♂ Fls.	♀ Fls.	♀ Fls.	♂ Fls.	♀ Fls.			
3-1	102	91	24	500	100	—	1000	200	200	∞	+ 2502	583	541					
3-2	130	130	80	400	480	500	360	480	120	∞	+ 3446	4892	3251					
3-3	340	360	20	200	50	—	800	400	—	∞	+ 1920	1906	182					
3-4	—	—	—	—	—	—	—	—	—	∞	10	10	4					

CECIL YAMPOLSKY

GRANTWOOD, N. J.

COMMENTS ON A RECENT CHECK-LIST

RESEARCH stations established in the past by scientific institutions, especially those in or near the tropics have generally been devoted particularly to study of aquatic organisms. It was, therefore, with great pleasure and with high hopes for its future that naturalists all the world over have watched with keenest interest the establishment and gradual development of the Tropical Research Station of the New York Zoological Society.

Mr. Beebe has shown great acumen in selecting his locality. His facile pen has drawn the wonders of his station's environment in a way so splendidly vivid that I, for one, envy very frankly his skill and his good fortune. These comments then are offered here, on one of his recent papers, with a cordial appreciation of the debt which all naturalists owe to him for what should in the future become the most useful workshop of its kind: indeed to be thought of always in future as bearing a relation to the tropic rain-forest in the same way that one subconsciously recalls the Naples Station when thinking of or discussing the fauna of the Mediterranean Sea.